

Frequently Asked Questions: Petroleum products and crude oil

Where does Washington get our gasoline, diesel, and jet fuel?

There are five oil refineries located in Washington State producing a full range of refined petroleum products. These refineries and their 2003 maximum production capacities are listed below. A barrel of crude oil contains 42 gallons.

- BP West Coast Products LLC (Ferndale @ 225,000 Barrels per day)
- Shell Oil Products US (Anacortes @ 145,000 Barrels per day)
- ConocoPhillips (Ferndale @ 93,000 Barrels per day)
- Tesoro West Coast (Anacortes @ 115,000 Barrels per day)
- U.S. Oil & Refining Co. (Tacoma @ 35,150 Barrels per day)

More information about Washington's petroleum usage, follow the Energy Information Administration (EIA) link. <http://tonto.eia.doe.gov/oog/info/state/wa.html>

Where does the crude oil supplying Washington states refineries come from?

Refined petroleum products, such as gasoline and diesel, come from petroleum, which is more commonly referred to as crude oil. Washington State does not produce any crude oil, but instead relies on imports to supply its needs (2003 import data). This oil is from:

- Alaska (74%)
- Canada (9.6%)
- Argentina (5.3%)
- Saudi Arabia (4%)
- other foreign imports (7%)

The North Slope region of Alaska has provided the majority of Washington's crude oil imports for the last 25 years. However, North Slope production has seen a 55% decline in production since its 1988 peak, and other oil producing regions have begun to supply the Washington refineries. Over the next twenty years crude oil imports are expected to increase, particularly from the oil sands regions of Alberta (Canada), where bitumen, a very heavy oil, and synthetic crude oil are produced (primarily) for export to the U.S. market.

How does the crude oil arrive at Washington's refineries?

Most crude oil arrives at the refineries by tanker or barge. A small fraction enters from Canada on the TransMountain pipeline, which was recently purchased by Kinder Morgan. As production of synthetic crude from Alberta oil sands increases, it is anticipated the TransMountain pipeline delivery capacity will be expanded. Refined petroleum products also enter eastern Washington via the Yellowstone and Chevron pipelines.

The Magnusson Amendment of 1977 has been in the news lately. How does the amendment impact crude oil delivery and tanker traffic on Puget Sound?

The amendment bars federal permits for any expansion of Puget Sound refinery capacity to handle crude oil, except as needed for meeting instate consumption. Written the year oil began to

flow from Alaska's North Slope, it halted plans for a supertanker port at Cherry Point near Bellingham. Magnuson also secured a Coast Guard rule limiting the size of oil tankers in Puget Sound to 125,000 deadweight tons and 35 million gallons of crude, well below supertanker scale: 188,000 deadweight tons and more than 50 million gallons. Recently Senator Ted Stevens of Alaska has sought to alter the 1977 amendments so Washington refineries could accept additional Alaska crude oil, transported aboard supertankers, in the event oil exploration and production is allowed in the Arctic National Wildlife Refuge.

What refined petroleum products do the refineries produce and how much do Washington residents consume?

The refineries produce a full range of refined petroleum products, but the most common products are:

- gasoline (49 percent)
 - diesel/distillates (25 percent)
 - jet fuel (13 percent),
 - residual fuel (9 percent)
 - The remaining 4 percent include asphalt, LPG (liquefied petroleum gas) and petroleum coke.
- (Based on 2003 EIA data)

In 2002 residents of Washington consumed a total of 16.9 million gallons per day of refined petroleum products.

- 7.5 million gallons per day of gasoline
- 2.9 million gallons per day of distillate
- 2.1 million gallons per day of jet fuel
- 0.8 million gallons per day of LPG
- 0.6 million gallons per day of residual fuel.

How are refined petroleum products distributed?

Petroleum products produced at the five refineries are distributed throughout Washington and to other parts of the Northwest by the Olympic Pipeline, barge and truck. Eastern Washington also receives some petroleum products from the Yellowstone Pipeline, which originates in Montana, and the Chevron Pipeline, which originates in Utah. Roughly one percent of the refined petroleum products used in Washington are imported from foreign countries or other parts of the U.S.

Basic map showing petroleum product pipelines in Washington:

<http://www.atg.wa.gov/consumer/gasprices/images/graphs/Slide1.GIF>

Does Washington State export refined products: gasoline, diesel, and jet fuel?

The five oil refineries located in Washington State produce significantly more refined petroleum products than are used by Washington residents. About 25 percent of output from the five refineries is exported. When eastern Washington pipeline imports of refined product are included the net refined product exports from the state are roughly 20 percent.

Most of the petroleum product exports are gasoline, diesel, and jet fuel sent to Oregon and California markets, the latter which usually commands a price premium of several cents per gallon. A small amount of residual fuel oil is sent to Asian markets.

Is demand for crude oil and refined petroleum products increasing?

Over the last 25 years demand for refined petroleum products has been increasing at about 1.7 percent (average rate) per year in Washington, or just a bit more than the state's long-term population growth rate. See Chart 3 below for an illustration of US demand growth. In the early 1980's demand actually fell for several years, but began to increase again as fuel prices declined in the mid 1980's. Most of the increase in demand has been for transportation fuels, with gasoline demand up by more than 50 percent, diesel (distillate) demand up by more than 40 percent, and jet fuel demand up by more than 100 percent since 1980.

Link showing petroleum consumption over time: <http://www.eia.doe.gov/emeu/states/states.html>

Why are crude oil and refined product prices increasing?

There are several factors energy analysts cite as responsible for the current high and volatile prices for crude oil and refined petroleum product. These factors are:

1. Rapid growth in global demand over the past few years has created a tight balance between available crude oil supply and demand. In 2005 the world spare production capacity was estimated at around 1 million barrels per day, out of total consumption of about 84 million barrels per day, and was primarily heavy crude production which is not in high demand. Spare production capacity of 3 to 4 million barrels per day is thought to be necessary to avoid price spikes from the frequent supply disruptions which occur in the world oil markets.
2. A shortage of light sweet crude oil. Much of the world's refineries are setup for light sweet oil (low viscosity and low sulfur/impurity content), the production of which has not kept pace with demand growth over the last several years.
3. Forecasts of continued crude oil demand growth despite high prices. Although global demand growth for 2005 (1.2%) and 2006 (1.5%) is forecast to be lower than in 2004 (3.2%), long-term growth is still expected to be robust.
4. War and terror price premiums remain. Although increased security measures have lessened the war and terror price premiums in the eyes of petroleum market participants, it is still adding perhaps 10% to the price of petroleum.
5. A shortage of world refining capacity, particularly in the United States. Refineries in the U.S. are operating at nearly 95 percent capacity; any sizable production upset results in price increases for refined products.

Other factors, such as market speculation by large hedge funds, and threats of oil worker strikes, and weather related supply disruptions periodically unsettle the petroleum markets. Political and or legal uncertainty in Russia, Venezuela, Iran, and the Caspian Sea region also adds to market concerns about future supply.

What are the most important contributors to the price of gasoline and diesel?

The retail price of gasoline and diesel is usually broken out into four categories: crude oil cost, refinery margin, dealer margin and taxes. The refinery margin includes the cost and profit from refining the crude oil into products, while the dealer margin is the costs and profits the retailer realizes when selling gasoline or diesel. The cost of crude oil is traditionally the largest price contributor to final retail price: currently the cost of crude oil represents about \$1.40 per gallon

(55 percent) of the retail cost. The refining margin is highly variable (primarily the profit portion), but has been averaging about \$0.45 per gallon (nearly 20 percent) of retail cost. Federal and state taxes are currently \$0.51 per gallon (about 20 percent), while dealer margins average around \$0.15 per gallon (about 7 percent). Chart 1 below illustrates the component costs of California gasoline (a close proxy for Washington gas) over the past 6 years. Notice the volatility in the prices for the refiner and dealer margins – scarcity brings high margins, surplus low margins.

How do recent gasoline and diesel prices compare to historical prices?

In nominal terms (dollars of the day, not adjusted for inflation) gasoline and diesel prices during September and October of 2005 were the highest ever recorded. Expressed as inflation adjusted dollars, gasoline and diesel prices for 2005 averaged \$2.39 and \$2.62 per gallon respectively. Last years (2005) average gasoline price is the second highest annual average in the last 25 years, while the diesel price (2005 average) is the highest ever recorded. Adjusted for inflation, historical gasoline prices in Washington peaked in 1981, when prices were higher than today's prices. In 2005 dollars a gallon of gasoline in 1981 would cost about \$2.56 per gallon. After the second oil crisis in the late 1970's and early 1980's, average gasoline prices generally declined and by 1998 reached an all time low of \$1.27 per gallon expressed in 2005 dollars. In 1970, a gallon of gasoline cost about \$1.46 in 2005 dollars. Chart 2 illustrates the upward trend in state weekly average gasoline and diesel prices (nominal dollars) over the last 3 years. Note the upward trend in fuel prices as demand increased following the 2001 recession. Prices tend to spike in the summer when demand is highest, but also went up after the US invasion of Iraq, which temporarily removed 2 million barrels per day (approx. 3%) from the global market. Damage to crude oil production and refinery infrastructure from hurricanes Katrina and Rita produced the price spike in September of 2005. Reversing a long-term pattern, diesel fuel has been more expensive than gasoline during most of the last 2 years.

EIA link for gasoline and diesel prices: <http://tonto.eia.doe.gov/oog/info/gdu/gasdiesel.asp>

AAA link for gasoline and diesel prices: http://www.aaawa.com/news_safety/news_room/index.asp

Why does the price of gasoline increase during the summer?

Demand for gasoline usually peaks during the period from late June through August as people drive more during the summer. Gasoline demand starts to fall in early September and reaches its lowest levels in January. If petroleum prices are stable, retail prices for gasoline tend to follow the demand pattern: higher in the summer, lower in the winter.

The price for diesel fuel follows a slightly different pattern, since diesel and home heating oil is nearly the same product. Demand for home heating oil starts to increase in September and is strong through January. If petroleum prices are stable, retail prices for diesel often rise in the fall and decline in the spring. The link between home heating oil and diesel fuel has become weaker over time as Washingtonians use less heating oil and more natural gas to heat their homes. In 2004 the state used 52 million gallons of home heating oil (residential sector only), while 20 years earlier 127 million gallons were used.

How do our gasoline and diesel prices compare with prices in other parts of the country?

Retail fuel prices on the west coast are higher than most other parts of the country (see Chart 2). There are several likely explanations for this occurrence:

1. The west coast is isolated from the primary petroleum and refined product markets in the Gulf coast making our region susceptible to market imbalances.
2. The west coast market is in supply deficit for refined products (not enough refineries to supply regional needs) and so the region must pay a bit more to attract cargoes of gasoline and diesel product from other parts of the world. The California and Arizona/ Nevada markets are the primary cause of the regional supply deficit.
3. Gasoline taxes are generally higher on the west coast.
4. The west coast generally has more specialty fuel requirements which add cost.

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Is there any evidence of price manipulation in the petroleum product markets in the Pacific Northwest?

There is no evidence of overt price manipulation by oil companies or distributors in the Pacific Northwest, despite claims by some critics. The Washington Attorneys General Office through its consumer protection division has been tasked with monitoring the transportation fuel markets and has not found any evidence of market manipulation. The US Government Accounting Office has also evaluated national and regional transportation fuel markets and has not uncovered any overt market manipulation, though a limited number of local price gouging events by retailers and distributors have been observed. Studies of recent market mergers across the nation do suggest some limited market pricing power may have developed in some areas.

Washington Attorneys General Office - Consumer Protection Division.

<http://www.atg.wa.gov/consumer/gasprices/releases.shtml>

Why did Washington gasoline and diesel prices spike after hurricanes Katrina and Rita?

The fuel price increases during September of 2005, following the destruction of oil and refinery infrastructure by hurricanes Katrina and Rita, have initiated a series of national and regional investigations into pricing behavior by oil companies, distributors and retailers. While the results of these investigations are not available as of this publication, many energy analysts and economists have stated the market behaved in a rational manner, which is summarized in the paragraph below.

Prices were already high and rising in the US transportation fuel market in August 2006, primarily the result of high world crude oil prices, but also because of a tight supply demand balance in the US gasoline and diesel markets. For September and much of October the damage from the hurricanes removed on average 5 percent of the nation's oil production and approximately 10 percent of the nation's refining capacity. In addition, the hurricanes disabled much of the pipeline infrastructure in the Southeast used to transport crude oil or refined products. The loss of refining capacity and pipeline infrastructure caused retail and wholesale fuel prices to quickly spike in the Southeast, Midwest and the East coast markets. Within a week the high regional wholesale prices for gasoline and diesel drew in product from other parts of the world, particularly the Caribbean and Europe. Eventually this diversion of foreign imports of gasoline and diesel (and some domestically produced products as well) impacted the other US fuel markets. Because California and the Southwest import a significant amount of gasoline and

diesel from some of the same suppliers, the hurricane induced shortages quickly produced a wholesale price ripple effect in the Southwest and the West Coast. Because Washington produces some gasoline and diesel for the California market, the higher wholesale prices in California, quickly translated into higher prices in Washington State. We had to pay higher prices in order to prevent even more fuel from leaving our market for the California market. An examination of the hurricane impacts on gasoline and diesel prices reveals the increases were smaller the further one got from the heavily impacted Southeast region. The higher fuel prices eventually accomplished two things: 1. Attracted replacement gasoline and diesel (not as effectively for diesel) from around the world, and 2. Quickly reduced US domestic fuel consumption by several percentage points, allowing the transportation fuel markets to rebalance supply and demand.

Why is diesel fuel more expensive than gasoline?

Until about 2 years ago the price of diesel was typically less than gasoline on an annual basis, though the price gap had been narrowing for years. Over the last ten or so years demand for diesel fuel has been growing faster than demand for gasoline at the regional, national and global levels, which has resulted in diesel being more expensive than gasoline: see Chart 3 which illustrates the long term growth in US use of gasoline and diesel. There are several reasons for the more rapid diesel demand growth:

1. Many nations, particularly those in the European Union, prefer diesel over gasoline. Some of this preference is policy driven, i.e. lower tax rates to promote diesel consumption over gasoline consumption.
2. With China, India and other developing nations entering the global markets over the last 10 to 15 years much more freight is being moved around the world. Most freight eventually ends up being moved to its final destination by a diesel powered truck or train.
3. Developing nations, such as China and India, often have unreliable electricity grids and resort to diesel generators for frequently used backup generation.

Are gasoline and diesel prices forecast to increase or decrease over the next couple of years?

The Energy Information Administration (EIA) is forecasting prices for crude oil will remain high in 2006 – near \$60 per barrel. By 2007 supply from a series of new projects will be entering the market and prices are forecast to decline towards \$50 per barrel. By 2014 prices are forecast to decline to about \$47 dollars per barrel (2005 dollars) and begin a slow, long term, increase over the next decade to approximately \$57 by 2025. In the U.S. limited spare refining capacity will tend to keep retail prices high, particularly for diesel fuel, during 2006 and 2007, though prices should retreat from the highs of 2005. Forecasts can't take into account random supply interruption. Another well placed hurricane like Katrina, or a successful large scale terrorist act on Saudi Arabian oil facilities, etc., could send prices rapidly higher over the short-term. The EIA forecasts also don't take into account overtly strategic behavior by oil exporting nations. Such behavior could also lead to higher world crude oil prices.

EIA Short-Term Energy Outlook: <http://www.eia.doe.gov/emeu/steo/pub/contents.html>

EIA 2006 Annual energy Outlook: http://www.eia.doe.gov/oiaf/aeo/pdf/trend_4.pdf

Are there adequate crude oil supplies for the future?

There is debate in the petroleum industry as to whether there are adequate crude oil supplies to sustain increasing global consumption levels over the next 20 to 30 years. The peak oil advocates note global petroleum discoveries have been trailing global petroleum consumption for at least 10 years. Many of the most productive fields in the Middle East are more than 50 years old and production is being sustained by more advanced and expensive extraction techniques. The advocates generally don't attach much production potential to less conventional petroleum sources such as heavy oil, oil sands, deepwater, oil shale, or alternative sources of liquid fuels such as (natural) gas-to-liquids, or coal-to-liquid techniques. Some of the advocates believe because of the huge development costs, these unconventional resources will only be pursued in a large scale manner after conventional production peaks and petroleum prices are sustained at very high levels. Many of the advocates are former petroleum engineers or geologists and are therefore familiar with the petroleum industry and technology.

Link to Association for the Study of Peak Oil website: <http://www.peakoil.net/>

Others in this debate believe that large quantities of conventional oil are yet to be discovered and that the reason discoveries have lagged consumption since around 1990 is because low prices have limited the incentive for oil exploration. These optimists think new technologies, such as 4-D seismic, horizontal well drilling, and enhanced oil recovery technologies such as carbon dioxide injection, will greatly add to the amount of crude oil that can be found and recovered. They also believe unconventional oil resources will add significantly to global production over the next 20 to 30 years. This group includes representatives from large and very skilled organizations such the Energy Information Administration, and the International Energy Agency, as well as representatives of several national and public oil producing entities.

Link to EIA petroleum analysis website: http://tonto.eia.doe.gov/dnav/pet/pet_pub_top.asp

The main agreement is there are adequate crude oil supplies for at least 10 and probably more like 25 years. This does not mean oil prices will be low or even reasonable as strategic behavior by OPEC, or political turmoil in the Mideast or Russia could remove supply from the market even though the capacity to produce oil exists.

Are there any prospects for Washington to produce crude oil?

Some exploration has been carried out onshore and offshore, with no strong indications of significant oil resources. There may be some commercial quantities of crude oil and natural gas off the Washington coast. Currently there is a moratorium on exploration and development of these resources on much of the west (and east) coast of the United States. The 2005 Energy Policy Act contained provisions to assess these types of resources.

Are there alternatives to petroleum and refined petroleum products?

There are a series of alternatives to traditional petroleum and products. These range from synthetic petroleum and product resources to complete substitutes for gasoline and diesel. A partial list is given below:

1. At today's oil prices synthetic petroleum can be derived economically from oil sands and perhaps from oil shale, though probably not from coal. Synthetic petroleum can be directly processed in traditional refineries, but overall is much more expensive to

produce, and requires significant energy inputs. The ratio of energy out to energy in for synthetic oil is currently much lower than for conventional oil.

2. Ethanol and biodiesel are direct substitutes for gasoline and diesel and can also be blended with these traditional transportation fuels. These alternative fuels result in lower greenhouse gas emissions and displace more energy than they consume during production (ethanol less so than biodiesel). Currently, ethanol and biodiesel rely on field crops (sugar cane, corn, soy beans, rapeseed, etc) and so limits on agricultural land and competition with other crop end users will restrict these substitutes to perhaps 5 to 10 percent of current gasoline and diesel volumes.
3. Hydrogen and electricity. Many consider the ultimate replacement for the internal combustion engine to be the hydrogen powered fuel cell. Currently, fuel cell and hydrogen storage costs are much too high to compete with internal combustion engines. Reliability and fueling infrastructure problems also prevent rapid adoption of fuel cell powered vehicles. Electric powered vehicles are another potential replacement, though limited range, long recharge times, and battery weight and cost issues have prevented their adoption. A cross type of vehicle the Plug-in Hybrid Electric Vehicle (PHEV) can theoretically achieve very high (gasoline or diesel) fuel economy and is another possible substitute, though advances in battery technology will be necessary. The PHEV is similar to a current Hybrid Electric Vehicle (HEV), but has a smaller gasoline or diesel engine than a HEV and a larger advanced design battery pack that can also be plugged in and recharged.

Presentation of alternative energy resources: <http://www.eere.energy.gov/>

For further information contact Greg Nothstein at gregn@cted.wa.gov, or (360) 956-2098. This document was last updated during March 2006.

Chart 1: Gasoline component costs, 1999-2006. Source: California Energy Commission.

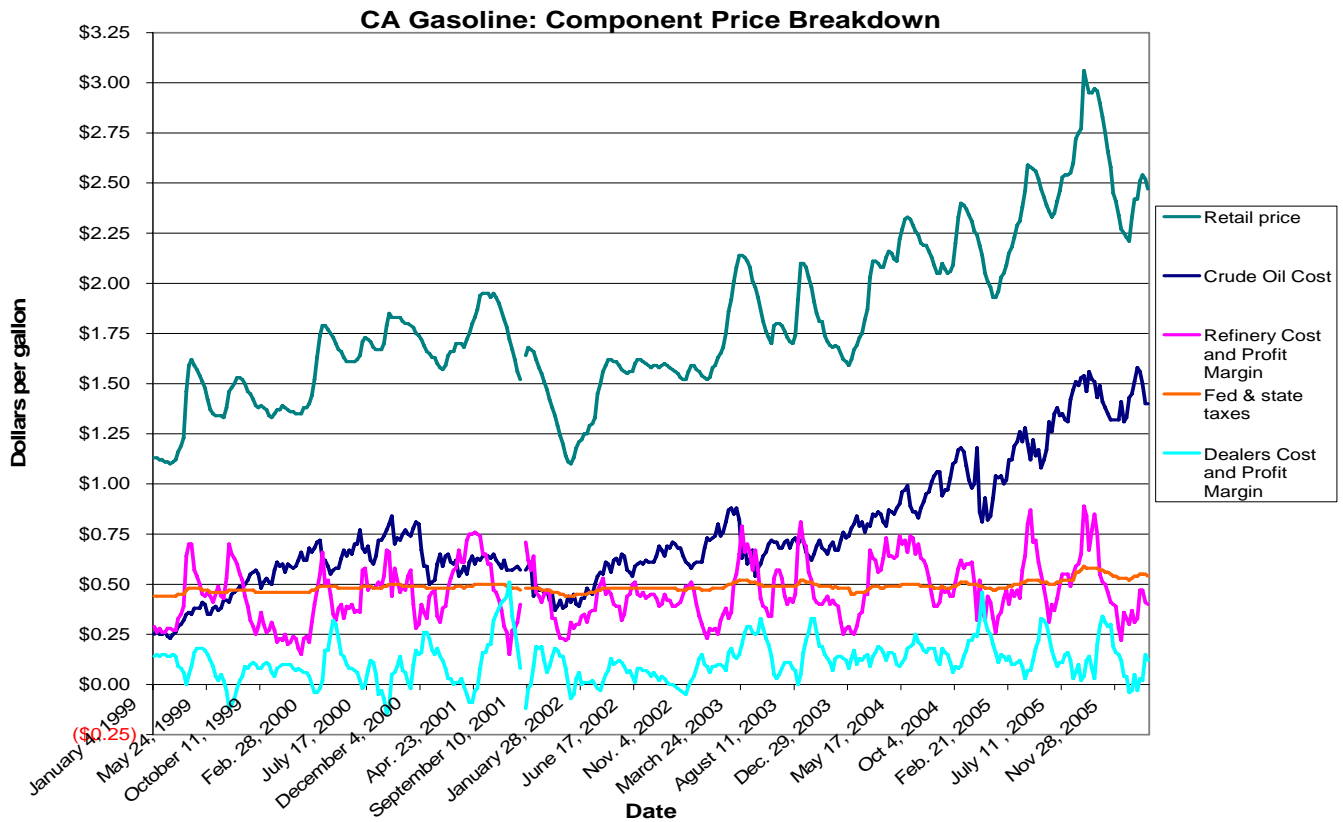


Chart 2: Washington gasoline and diesel prices: Source AAA of Washington.

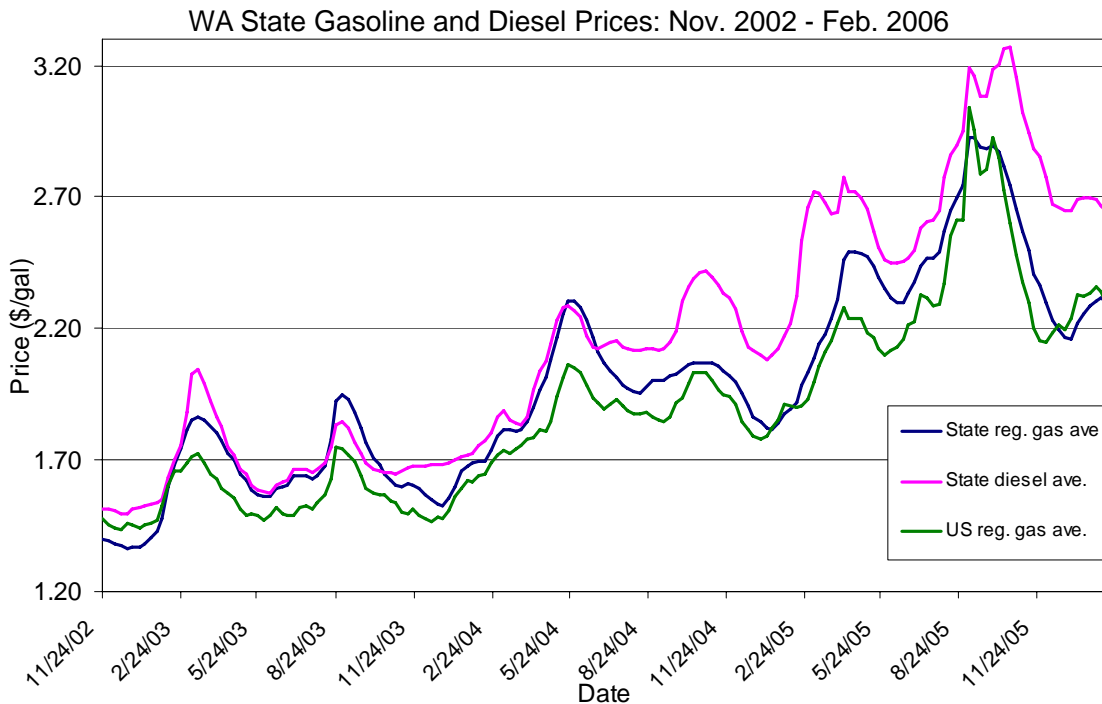


Chart 3: US highway (on road) use of gasoline and diesel fuels.

US highway fuel usage

